Final Project Summary Report
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Multiwaveband Monitoring of the Radio Galaxy 3C 120

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This project started new weekly observations of the radio galaxy 3C 120 during Cycle 3 (1998) of the RXTE mission. The light curve displayed in Figure 1 displays these data along with archival Cycle 2 data from early 1997 and Cycle 4 data from the PI and collaborators from 1999 to early 2000. It is clear that the weekly observations in 1998 did not resolve the variations of the X-ray emission. The most prominent features are three dips in the X-ray flux, separated from each other by about one year.

The dips (as well as the the general flux level) is not correlated with the radio emission, shown in the bottom three panels of Figure 1. However, the times of the dips coincided, within the errors, with the times of zero separation between apparently superluminal features in the radio jets (as observed on VLBA images - see Fig. 2) and the cores of the jets. This is potentially a very exciting finding, which would, if confirmed, link the physics of this radio galaxy with that of the binary star system in our Galaxy, 1915+105. The X-ray dip would then be interpreted as the dissociation of the inner accretion disk, with the extra accretion onto the black hole being accompanied by enhanced flow of energy and material down the relativistic jet. This would result in the creation of the observed new superluminal knot.

Work is continuing under the auspices of an Astrophysical Data Program grant to confirm the X-ray dip/superluminal ejection connection through careful analysis of the VLBA data, which is just now becoming available for late 1999/early 2000.

No publications have yet resulted from this project. This was the first of a two-year project to determine whether there is a connection between the X-ray and radio emission from 3C 120. Publication of the results will occur through the ADP grant during the next six months.

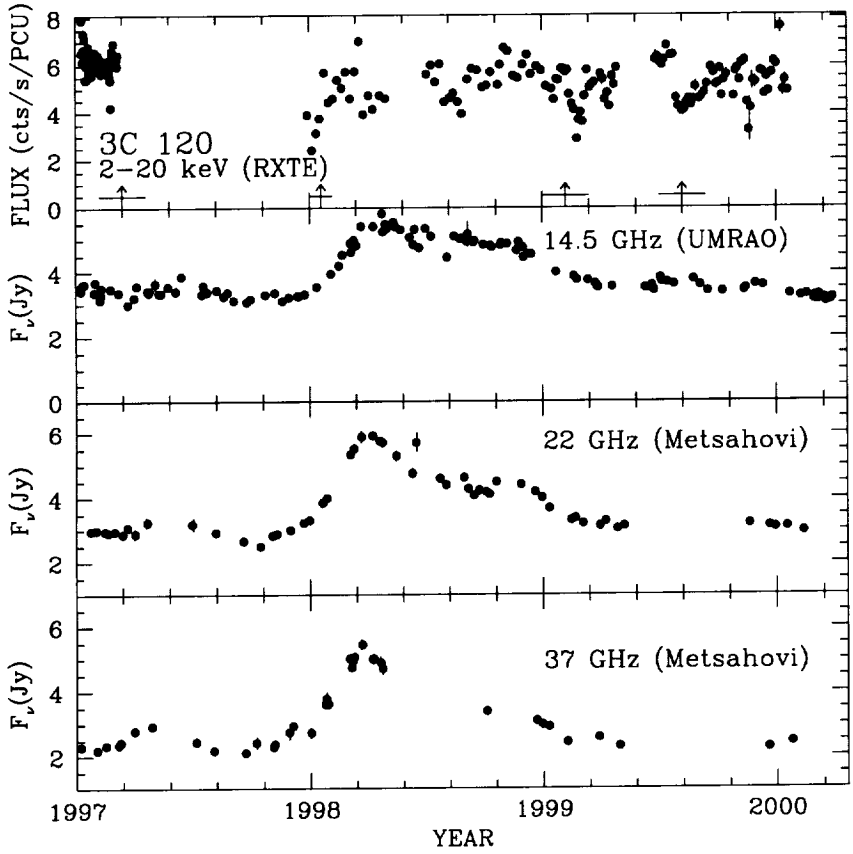

Fig. 1. Upper panel: RXTE light curve of 3C 120, from the investigators' data of 1998–early 2000 plus archival data from early 1997. The vertical arrows indicate epochs of ejection (uncertainties in which are indicated by the horizontal lines) of superluminal components from the radio core (from data by the PI's collaboration). Lower three panels: the University of Michigan 14.5 GHz and Metsähovi 22 and 37 GHz flux measurements. The four epochs of ejection of superluminal radio knots are coincident with dips in the X-ray light curve.

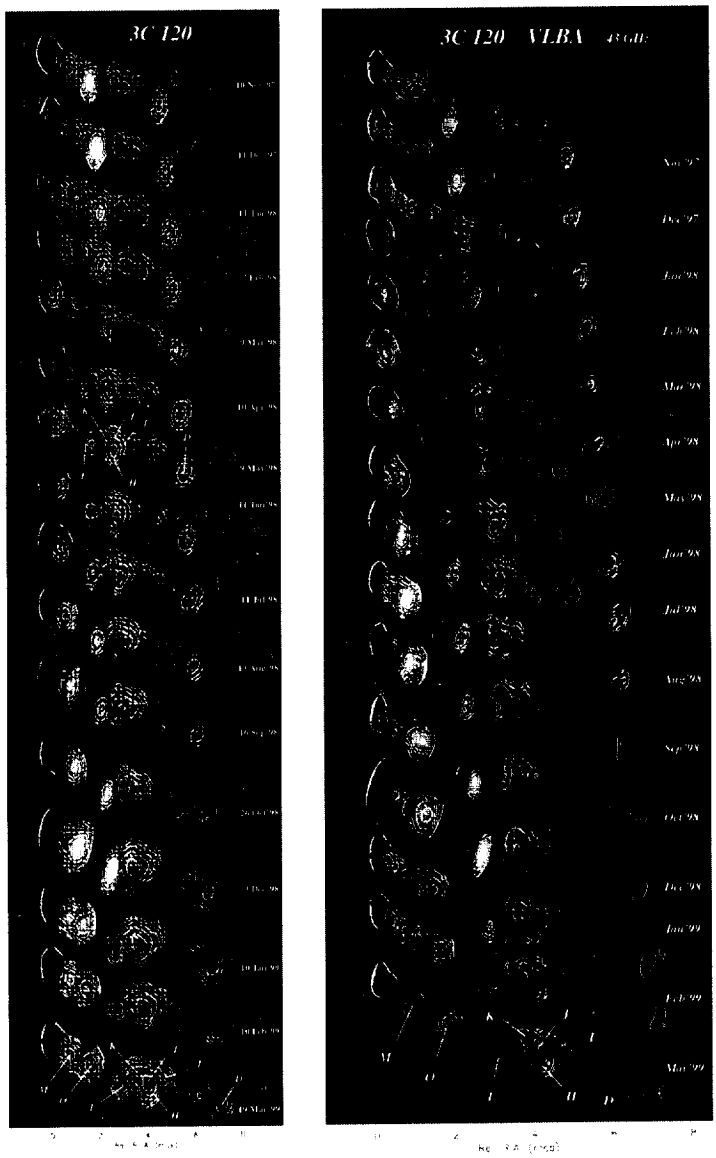

Fig. 2. 16-month sequence of monthly VLBA images of 3C 120 at 22 GHz (left) and 43 GHz (middle). The logarithmic contours correspond to total intensity and the white scale to polarized intensity. The sticks indicate the direction of the magnetic polarization vectors. The restoring beam is indicated to the left of each image. The right panel shows an 11-month sequence of the radio galaxy 3C 111 at 43 GHz; see the caption to Fig. 1 for the format. The cores of both radio galaxies are unpolarized to within the uncertainties. The epochs of zero separation between moving features and the core indicated in Fig. 1 were obtained through analysis of these data plus further images obtained later in 1999 that have not yet been added to the sequence of images from the previous epochs shown in this figure.